

CHARACTER AND NUMERICAL RECOGNITION SYSTEM USING FEED FORWARD AND BACK PROPAGATION NEURAL NETWORK

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ABSTRACT

In this proposed system, a neural network for characters and digits recognition is proposed by using algorithms to the neural network. The neural network can effectively recognize various characters of different languages such as Tamil, Hindi, English Malayalam and other language characters and even digits with higher rate of accuracy of recognition can be built using the Neural Network. A Back Propagation (BP), Feed forward (FF) and classifying algorithm is capable of reducing the number of neurons correspondingly and increasing recognition rates for the fixed number of output. Neural Network (NN) is a computational model or mathematical model based on biological neural networks. There are various research are going on the recognition system using neural network bionic man is one of the best example for the application of the neural network. NN consists of an interconnected cluster of artificial neurons and which processes information using a connectionist approach to computation of the results. In certain cases NN is an adaptive system that changes its structure based on the internal and external information that flows through the network during the beginning phase (learning). They can be used to model complex relationships between number of outputs and inputs or it can able to find patterns in the given data. The simulations result has been provided for the verification and to see the performance of the recognition.

KEYWORDS: Neural Network (NN), Digital Recognition, Character Recognition, Feed Forward & Back Propagation Algorithm, Classifying Algorithm

INTRODUCTION

A NEURAL NETWORK (NN) has a massively parallel structure which is composed of many processing elements connected to each other through weights [1] [3]. Neural networks (NN's) are built after biological neural systems it is used to determine the response of stimuli from the pathogen or host. A NN has many advantages such as high performance rates, good accuracy and faster response than those of other recognition system. NN is used in various kinds of character and digits recognition problems, especially where input characters or digits are shifted in position and scale-changed as discussed in [4], [5] which gives a detailed description about the Neocognitron, which is in-sensitive to translation the give input data and deformation of input characters and digits, and which is used to recognize hand written characters. Neural networks (NN) have been widely used to solve complex problems of pattern recognition and they can recognize patterns very fast after they have already been trained. There are two types of training which are used in neural networks. These are supervised and unsupervised training [2], of which supervised is the most common. In supervised training, the neural network assembles a training data set. In this data set it contains examples of input patterns together with the corresponding output results along with the source file as in the database, now the network interferes the

relationship between output and input, results through training as said in [3]. To adjust the network's weights and bias so as to minimize an error function rate, such as the mean squared error function (*MSE*) described in [3], it undergoes the training state and try to classify all patterns given in the training data. Next to training, the NN will have biases and a set of weights that will be used to recognize the new patterns. Here we used the handwritten digits and character patterns.

Recently, a lot of works was done by depending on the computer; In order to let the processing time to be reduced and to provide more results that are accurate, for example, depending on different types of data, such as characters and digits and the numbers are used frequently in normal life operation. In order to automate systems which are dealt with numbers such in the fields such as banking, registration, ticket booking, postal code, and vehicle number plate. An automatic recognition of character and number is devised in a proper procedure which is proposed in this study. Various approaches are developed in the current scenario in field of image processing and pattern recognition has been developed by scientists and engineers to solve this problem as described in [1], [6]. In this setup which is proposed recognizes digits and characters from the input fed from the source file.

LITERATURE STUDY

- **Definition of Character and Digits**

Character and digits is the basic building block of any language that is used to build different structures of a language. Characters are the alphabets and the digits are the numbers. The structures are the words, numerals, strings, and sentences etc. [1]

- **Optical Character Recognition**

Optical character recognition (OCR) is one of the best methods of recognition of characters which is used in the software platform MATLAB; it's a process of converting an image, such as a handwritten files, scanned document or electronic fax, into editable text files. The input given image files are not editable, the letters and digits are composed of small tiny dots (*pixels*) that all together form a complete picture of text and numbers. The software analyzes the input given image and converts the pictures into an editable text based on the patterns and shape of the pixels in the image. Finally OCR, can export the converted text

- **Scope of Study**

The scope of this project is to build a system, that automatically recognize the characters and digits input to the system, and later on they may be used for different purposes of the application domain presented.



Figure 1: Examples of Different Shapes in Number 4

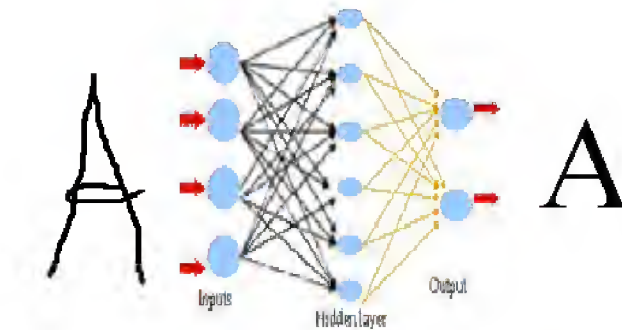


Figure 2: Scenario of Number Recognition with Artificial Neural Network

- **Framework**

Figure 1 shows some examples of different user handwritten and in Figure 2 the scenario of number recognition with Artificial Neural Network Which contains input and hiding layer and output with the English character for examination the Network.

DEVELOPMENT OF CHARACTER AND DIGIT RECOGNITION USING NEURAL NETWORK

- **OCR Data Pre-Process Unit**

The OCR digits and alphabet are preprocessed and provided as the input files from the source file to the application. The digits from 0-9 and characters from A-Z are feed as input images. Each digit and character is provided with ten different handwritten samples each for the training module.

- **Feed Forward Neural Network Representation Unit**

A Feed Forward Neural Network is an artificial neural network where connections between the units do not form a directed cycle. This is different from recurrent neural networks. The feed forward neural network was the first and arguably simplest type of artificial neural network devised. In this network, the information moves in only one direction, forward, from the input nodes, through the hidden nodes (*if any*) and to the output nodes. There are no cycles or loops in the network.

- **Training Unit**

The Back Propagation Algorithm is a common way of teaching artificial neural networks how to perform a given task. It requires a teacher that knows, or can calculate, the desired output for any given input. It is most useful for feed forward networks. Back propagation algorithm learns the weights for a multilayer network, given a network with a fixed set of units and interconnections. It employs gradient descent rule to attempt to minimize the squared error between the network output values and the target values for these outputs.

- **Digit/Character Recognition Unit**

This is the final test where a test input character or digit is entered by the user and is recognized using a classifier algorithm. Figure 3 shows the character or digit is recognized as the character digit with corresponding highest node value.

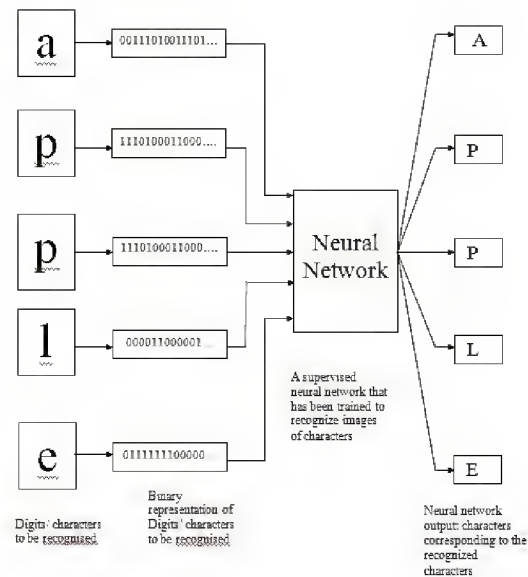


Figure 3: Block Diagram for Character Recognition Using Neural Network

- Algorithm**

Step 1: Load image file

Step 2: Analyze image for characters for each character

Step 3: Analyze and process symbol image to map into an input vector

Step 4: Feed input vector to network and compute output

Step 5: Convert the Unicode binary output to the corresponding character and render to a text box.

The above figure 1 is an example for this algorithm.

Training Algorithm

The algorithm for train the given data is given below with the graph

```

nrnd=unidrnd(392,1,392);      %get the random number

p=1;

e=0;

bji=0;

bkj=0;

while p<393

    x=sample(:,nrnd(p));      %x is 64*1

    t=teach(nrnd(p));         %t is 1*49

    netj=wji*x;               %netj is 48*1

    yj=f(netj);               %yj is 48*1

```

```

netk=wkj*yj;          %netk is 48*1
z=f(netk);            %z is 1*49
% z=round(z);
sk=(t'-z).*df(netk);   %sk is 49*1
bkj=it*sk*yj'*(1-r)+r*bkj;
wkj=wkj+bkj;          %
sj=df(netj).*(wkj'*sk); %sj is 48*1
bji=it*sj*x'*(1-r)+r*bji;
wji=wji+bji;
j=(t'-z)'*(t'-z);
e=e+j;
p=p+1;
end

erms =sqrt(e/392);
jj=[jj,erms];
end

%% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %% %%
Plot (jj);
title('training process');
xlabel('with momentum ');
ylabel('error');

save wkj2(2).dat wkj -ascii
save wji2(2).dat wji -ascii

```

RESULTS AND DISCUSSIONS

The network has been devised and tested with Arial font type in the Tamil alphabet set. Since the implementation of the software is open and the program code area is scalable, the inclusion of more number of fonts likes Tamil Malayalam, Hindi and other characters can also be made for various types of recognition.

The necessary procedure for preparing the sequence of input symbol images in a single image file (*.bmp extension), typing the corresponding characters in a text file.

MATLAB was used to implement our proposed system is shown in Figure 4. The output and result are shown in below.

Please enter the testing number: 2

Please enter the testing picture: 3

Testpicvector

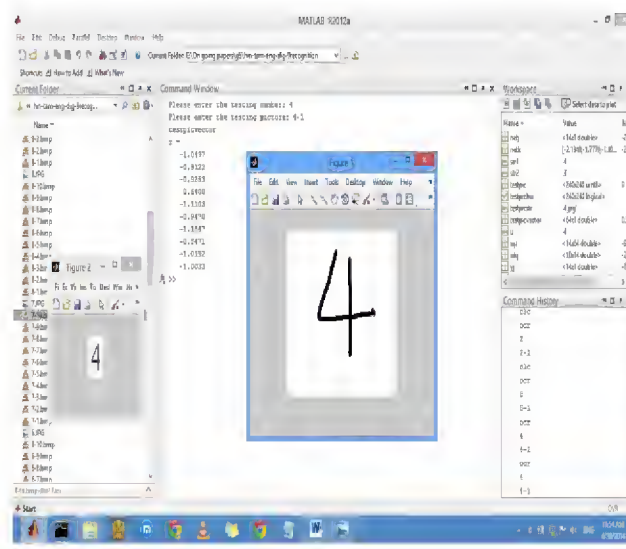


Figure 4: Output of Numerical Values

$z =$

-0.9890	-2.6543
0.7977	-2.7654
-0.7539	-3.2345
-0.7443	-3.2456
-0.9931	-3.3456
-1.0887	-3.4567
-1.1746	-3.5567
-1.0255	-4.5434
-0.7654	-4.5643
-2.4534	-4.5654
-0.4564	-4.6765
-2.4632	-4.7654
-0.3455	-5.5435
-2.5643	-5.6532

-0.9846

1.0178

-0.8254

-0.9609

-0.9111

Our system identifies individual character with an accuracy of 98.3%.

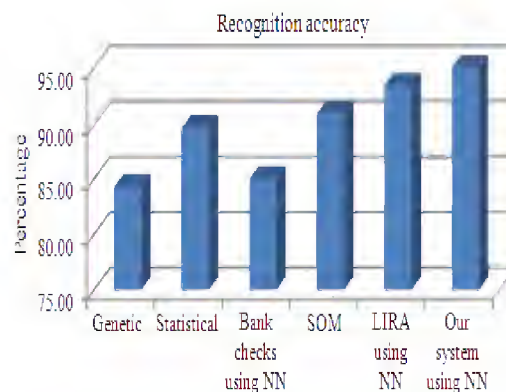


Figure 5: A Comparison between the Theories with Our System in Terms of Recognition Accuracy

CONCLUSIONS AND FUTURE DIRECTION

In this proposed system we had dealt with the character and numerical recognition with the output results and there performance value in a detailed way using the text segmentation and text recognition approach, with the given setup it's possible to recognition Digits, and English characters. Our proposed character recognition algorithms operate on input image and efficiently recognize the individual characters. Our future work is to enhances and to speed up the computational rate of the system to produces instant results

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